ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE ECONOMIC DEVELOPMENT: THE SINGAPOREAN EXPERIENCE

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ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE ECONOMIC DEVELOPMENT: THE SINGAPOREAN EXPERIENCE

by

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ABSTRACT

The environment is a resource people want to use for various purposes. An increase in economic production in a country, ceteris paribus, will lead to an increase in national income. The environment is a normal good. Therefore as economic production increases, people will also demand better environmental quality. In the absence of environmental management an increase in the level of economic production will lead to an increase in the level of pollution, ceteris paribus. Therefore, society has to find ways and means to resolve the conflict between the increase in production on the one hand and the preservation of the environment on the other, when considering inter-generational equity with respect to environmental quality.

The quantity and quality of the stock of resources available to Singapore may be considered as given. Maximising service to a given stock of resources is economic efficiency, which is one component of sustainable economic development. This paper will assume that the objective of economic efficiency is pursued by the Singaporean Government. Therefore the paper will be focussing on the objective of maximising the stock of resources to throughput, which is the other component of sustainable economic development. Since it is assumed that the stock of resources is given in Singapore, the objective of this exercise is to minimise the throughput to a given level of stock.

This paper will deal in detail with economic policies pursued in Singapore to achieve (a) energy efficiency, (b) reduction in congestion, (c) reduction in air pollution, (d) improvement in water quality and (e) waste reduction and waste disposal. The criteria that should be used in selecting the appropriate policy instruments to achieve sustainable economic development in Singapore are (a) efficiency, (b) acceptability, (c) equity and (d) flexibility. The paper highlights the importance of the market-based approach in environmental management, as it gives consumers and industries clear signals about the cost of using environmental resources. Finally, the paper also considers the role of institutions in achieving the desired environmental management strategy to achieve sustainable economic development in Singapore.
Environmental Management For Sustainable Economic Development: The Singaporean Experience

1. Introduction

The Brundtland Report, Our Common Future, defined sustainable development as "development that meets the needs of the present without compromising the ability of the future generation to meet their own needs" (WCED, 1987, p.43). This definition is closely related to the concept of inter-generational equity. Pearce (1990, p.24) gives the working definition of sustainable development as that which is "maximising the net benefits of economic development, subject to maintaining the service and quality of natural resources over time."

There are three main views about the environment. They are (a) anthropocentric (b) ecocentric and (c) ecofeminist views. According to the anthropocentric view, the environment is something to be used and enjoyed by humanity. Therefore the objective here is to maximise the value of the environment by considering both the use and the preservation of the environment. In the ecocentric view human values must be brought into harmony with the environment, since "natural systems possess intrinsic values that are independent of human values" (Oelschlaeger, 1991, p.9). The ecofeminist view on the other hand emphasises the complementary relationship between human and nonhuman rather than the superiority of the human race. They believe that "Mother Earth is a nurturing home for all life and should be revered and loved as in premodern societies" (Oelschlaeger, 1991, p.310). This paper considers the economic point of view, which is anthropocentric, as the goal of the environmental economist, and this is to achieve economic growth and development with minimum environmental damage.

The environment is a resource people want to use for various purposes. Economic production generally leads to the use of the environment. In the absence of environmental management, people's long-term welfare is threatened by the misuse that they make of the environment, in their endeavour to achieve economic growth.
This misuse of the environment is a result of market imperfections such as the common property nature of the environment. Furthermore, an increase in economic production in a country will, ceteris paribus, lead to an increase in national income.

The environment is a normal good - that is, it has a positive income elasticity - therefore as economic production increases, people will also demand better environmental quality. Therefore, society has to find ways and means to resolve the conflict between an increase in production and the preservation of the environment between the potential users of the environment.

The aim of the Singaporean government is to maximise service to throughput. Service to throughput is given by the following identity (Daly, 1983).

\[
\text{Service \over Service} = \text{Stock \times Throughput}
\]

Service is determined by the quantity and quality of stock of human bodies and stock of artefacts available to Singapore which is assumed to be given. Since sustainable development implies the maintenance of a constant-stock, the first objective at any given time is to maximise service to this constant stock in order to maximise service to throughput. This objective, called economic efficiency, is achieved by the following:

(a) by ensuring full employment of all resources including the people so that the economy is operating on the production possibility frontier.

(b) by improving the allocation of resources between alternative uses so that the society is on the economically efficient point on the production possibility frontier.
To deal with the relative scarcity, another point that may be added to the above is an improvement in the distribution of income.

This paper will not deal with this question of economic efficiency but will take it for granted that the objective is pursued by the Singaporean government.

The second objective which this paper will be pursuing, is to maximise the stock to throughput at any given time. Since the stock is assumed as given, this objective can only be achieved by minimising throughput to a given level of stock. "Throughput is the entropic physical flow of matter-energy from nature's sources, through the human economy, and back to nature's sink, and it is necessary for maintenance and renewal of the constant stock" (Daly, 1983, p.258). In other words, the environment is a composite asset and the objective of the government of Singapore should be to minimise the undue depreciation of this asset.

With growth over the years, the Singaporean economy has become transformed. Two important aspects of this transformation are the decline in population growth and a rise in information technology. Both of these will increase the degree to which current welfare levels would be sustainable.

2. The awareness of Singaporeans to protect the environment

A survey of 1000 Singaporeans carried out by Survey Research Singapore (SRS) in 1992 revealed that 95 per cent of the respondents felt that the government should give high priority to protecting the environment. In this regard, the government sponsored Clean and Green Week (CGW) programme has helped to bring about this increased awareness. The SRS of 1993 also revealed that the CGW had contributed to this increased awareness as it was shown to be an effective public education programme.

However, the SRS of 1993 also revealed that this greater awareness of
environmental issues did not translate into a growing demand for green products.

About 70 companies in Singapore involved in the Clean and Green Week. The amount sponsored by the Corporate Group in 1992 was $630,000 as opposed to $475,000 in 1991. In addition to the above CGW support by Corporate sponsors there are also individual programmes by companies such as Hong Kong Bank's "Care for Nature" programme, Mobil's "Singapore Environmental Heritage Series" and Fuji's "We Care", which accounts for thousands of dollars.

On the one hand, there are some companies sponsoring environmental causes as a result of their own commercial operations turning green. Examples of these are: organisations selling recycled paper or other environmentally-friendly consumer products, and even the selling of unleaded petrol by oil companies. On the other hand, there are others who try to improve their corporate profits by adopting marketing strategies to tap the green consumer market.

Hong Kong Bank's involvement in a three year reforestation programme at the Botanic Garden and in the emergency transplantation of coral reef near Santosa Island has helped it to increase its goodwill. This bank is seen as the leader in environmental issues and as such resulted in some depositors actually switching their funds to the bank (Straight Times, October 19, 1992, p.24).

3. Problems with achieving an environmentally acceptable economic system

The current generation can affect the welfare of the future generation in both negative and positive ways. Thus the actions of the current generation will determine whether it will enhance or hinder sustainable development.

The question is whether the benefits to the future generations from the current development path will be greater than the costs imposed on the future generation. It will be argued subsequently, that, left to itself the market will not lead to such an
outcome, that is, the market will not lead to a sustainable development path.

In this regard the most difficult problem is the time horizon within which people make their decisions. It is not enough for people to be convinced that they are collectively wasting the resources and damaging the environment of future generations. People should also be prepared to take into account that the decision they make will affect the future generations welfare. Left to themselves, they will not do this, especially when they find it hard to give their future needs an equal weightage to present needs or desires.

4. **Problems and policies pursued by the Singaporean Government in achieving sustainable environmental management**

(a) **Energy Efficiency**

Rapid increases in industrial activity, and in the number of cars will increase the demand for energy in Singapore. Promoting the efficient use of energy is a short-run measure in sustaining development. Increasing the efficiency in the utilisation of energy will allow for the increase in living standards without the need to increase energy consumption. For example, a well developed and efficient integrated public transport system aids in conserving energy utilisation of transportation fuels. This allows for more non-renewable sources of energy to be made available for future generations.

(b) **Reducing congestion**

Urban congestion is a source of pollution and economic inefficiency. Vehicle fuels are a source of airborne toxic pollutants of which lead and carbon monoxide form the main components. Past regulations have allowed for changes in engine design, in emission control devices and in the type of fuel used (unleaded petrol). It should be noted that many of these developments have not yet been fully incorporated into all types of vehicles. But all new petrol driven cars will need to have catalytic converters from 1st July 1994 (Sunday Times, 21/2/93, p.14) when the
new standard known as the Consolidated Emission Directive (CED) becomes effective. This CED is comparable to the US Federal and Japanese standards. However, the emission of volatile organic compounds and nitrogen oxide may increase, especially if there is an increase in motor vehicle fleets and an increase in the kilometres travelled.

One result of economic inefficiency of congestion is lost productivity. Singapore, being a city-state, cannot afford a 'grid-lock' in its traffic systems (speeds of vehicles falling to less than 10 kilometres per hour). A larger proportion of the population will be exposed to automobile pollutants.

Singapore has adopted some form of congestion pricing such as the Area Licence Scheme, (ALS) which involves area licensing and higher fees for parking within the Central Business District (CBD). The ALS will be extended to cover all day from January 1994. That is from 7.30 a.m. to 6.30 p.m. on weekdays and from 7.30 a.m. to 3.00 p.m. on Saturdays. This is aimed at evening out traffic flows. This ALS will continue until the electronic road pricing (ERP) scheme becomes effective in Singapore. The introduction of electronic road pricing (ERP) in 1995 will efficiently allocate traffic within the island. This should enable the government to increase the quota of vehicle certificates of entitlement due to the reductions in traffic congestion in heavy traffic areas.

At the same time the well developed mass rapid transport system (MRT) enables the people in Singapore to commute from place to place with less inconvenience. Thus the above measures adopted in Singapore are helpful in reducing road congestion and at the same time increasing accessibility. This helps in increasing the overall welfare of the people of Singapore, since movement of people and goods without much hindrance is a necessary condition for growth.

(c) Handling of Waste

In 1972, when the Environment Ministry was set up, about 1600 tonnes of
refuse per day was produced in Singapore. By 1982 this had doubled to 3200 tonnes per day. By 1992, it was estimated that this amount had risen to 6200 tonnes per day. This increase in the production of refuse creates enormous problems for a country like Singapore with limited land availability.

The waste could be divided into combustible and non-combustible waste.

**Combustible Waste**

With the increase in waste discharge, Singapore had to open a third incineration plant in October 1992. This plant, called the Senoko Incinerator Plant is situated near Sembawang which lies to the north of Singapore and is considered to be one of the largest with a capacity to incinerate 2400 tonnes per day. With the opening of this plant it is estimated that all three incinerator plants in Singapore can handle all the combustible waste produced in Singapore until the year 2000, on the basis that the growth pattern in waste production continues as in the past. But with greater environmental awareness and proper public policies it is possible that these three plants may be able to cope even beyond the turn of the century.

Furthermore, in addition to the reduced need to set aside land for dumping, the energy released from these incineration plants could be used to produce electrical power.

**Non-Combustible Waste**

At present the non-combustible waste is dumped at the Lorong Halls Dumping Ground, but it is estimated that the ground will be filled by the year 1998. If and when this happens, Singapore may have to resort to dumping inert waste at an offshore facility.

However, this problem of finding a suitable offshore dumping facility could be
avoided with proper economic policies that will encourage reducing, reusing and recycling some of the waste materials generated in Singapore. Garbage fees that could be based on the quantity of garbage disposed is one of those policies. Such actions will reduce the throughput that was discussed in Section 1, which in turn will assist in the achievement of sustainable economic development in Singapore.

(d) Handling of Sewage

Almost 100 per cent of Singaporeans enjoy modern sanitation. Out of the six sewage treatment works, four have been converted from open tanks to compact and covered sewage treatment tanks.

Covered tanks reduce the odour. This enables the current 1 k.m. buffer zone that is imposed on the open treatment tanks to be reduced to ½ k.m. This frees up the land for alternative uses. This will increase the available land supply to the Singaporean economy. The treated sewage is carried to the sea by pipes.

(e) Waste reduction

The aim of sustainable development is not only to reduce the demand on raw materials but also to reduce the discharge of waste into the environment. Waste water is being reclaimed and used for flushing toilets in residential and commercial buildings in Singapore.

The waste discharge will be reduced by increasing the possibility of using some of these waters as raw material or inputs for another product. This will be more relevant in the case of stock pollutants. Stock pollutants are pollutants where the environment has little or no absorptive capacity (Tietenberg, 1992). The move towards recycling resources has already begun in Singapore. Consumer habits are being changed. It should be noted that the benefit of recycling will accrue to the
individual only if all the members of the community follow recycling of waste and not use the environment as a dump.

Using the environment as a dump by any individual is rational in the absence of (a) a social conscience, (b) informal community sanctions and (c) formal legal sanctions. It is rational because the individual reaps the full benefit of using the environment to dispose of his or her waste products, but bears only a small fraction of the welfare damage cost of his or her pollution activity.

When the environment is not treated as a free good but as an economic commodity, the cost of waste disposal will rise. Together with stringent regulations on waste disposal, industries will be forced to reduce discharge. With the issue of transferable environmental permits for the discharge of effluents, the level of discharge can be kept below the absorptive capacity of the environment. This is a useful strategy when dealing with fund pollutants. Fund pollutants are pollutants where the environment has some absorptive capacity (Tietenberg, 1992).

If the cost of emitting pollutants from carbon or fossil fuels outweighs the additional cost in using non-carbon fuels, it will encourage the use of non-carbon based fuels.

5. **What institutional changes would such a system call for?**

Changes in values are fundamental to the emergence of the ecologically acceptable economic system. The essence of economic progress is that overtime the taste of the consumers and the opportunity set facing the consumers change, new ideas develop, leading to technological change. Therefore what is optimal today may not be a relevant alternative in the future. Therefore the aim of the institution should not be to cast economic development in concrete but to enhance the availability of resources and the environment for future generations. The human race is capable of finding new ways of achieving an improved quality of life. For example,
if the society takes into consideration the market failure aspect of the environment and take steps to correct for the problems of externality and public good characteristics of the environment, then the innovation of superior devices to monitor and control emission of pollutants will enable the future generation to have even higher levels of environmental amenities.

Even though it is true that the human race has a capacity to identify themselves with corporate institutions, the emphasis of our civilisation in the last century or so, has been placed upon the value of the individual. Thus an institution is required to bring about an ecologically sustainable development.

Left to itself, the market will not be able to achieve a sustainable path for the future. Market imperfections act as a constraint to sustainable development. The market imperfections are due to the common property nature of the environment. Left to itself a market will over exploit the environment, thereby lowering the net benefit of the future generation from the use of the environment.

Therefore, the major objective of the institution should be to correct this market failure and thereby internalise the external costs of pollution. Then, and then only will the economic development be a dynamically efficient or sustainable one.

Next, consider the institutional set up that will encourage recycling and reuse of waste material.

In the modern ‘throwaway’ society, a lot of waste is dumped on to the earth. Unfortunately, when matter is transformed from one state to another in the process of production, the earth is not capable of absorbing and assimilating much of the waste that is dumped on it. The accumulation of this type of waste is cumulative over time. This is further compounded by the growth in the scale of economic activity overtime. Thus an increase in the size of the waste overtime will create problems for sustainable development. One way to reduce this waste and enhance sustainable development is to encourage the recycling and reuse of material. In this regard a
deposit-refund scheme may be quite pertinent when dealing with bottles, cans and batteries. Such a measure will provide, implicitly, the incentive that is required to force environmental values in decision making.

People do react to incentives. Therefore, there should be economic incentives for people to reuse or recycle waste. That is, the benefit from reusing or recycling should outweigh the cost of dumping it on the earth to the individual.

For example, products produced by manufacturing processes which are environmentally damaging should be made relatively more expensive compared to those produced by environmentally friendly processes. The way to achieve this is to make all users of environmental resources pay their full cost. This principle would end the implicit subsidy that all pollution activities had received in the past from the society at large. This subsidy increases with the scale of economic activity. It should be remembered that when selecting the strategy to achieve the policy objective of minimising the damage to the environment, the cost-effectiveness of different strategies should also be taken into consideration.

With regard to the control of waste gas emission into the atmosphere, that are the result of industrial production - the fund pollutants, the practice in the past has been by way of 'command and control' regulations. Even though such quasi-market approaches may pay dividends when applied to some areas of impact such as roadside, urban and even rural areas, a case can be made for transferable pollution permits as the most cost effective way of controlling these pollutants in the industrial areas. Marketable pollution permits allow polluters some flexibility in meeting the desired level of emission (Pezzey, 1988).

One major problem with the 'command and control' regulation or the standard setting principle is that the polluters have to be caught. This is often difficult where, for example there are many polluters in the area, each contributing a comparatively small amount to the total level of pollution. The calculation that the polluter will do is to compare the expected value of penalty (that is, penalty multiplied by the
probability of being caught and successfully prosecuted) with the net benefit that he or she derives from pollution. Therefore, for the standard to be optimal, the penalty has to be certain (i.e. the probability of facing the penalty is 100 per cent) and it should be equal to the optimal level of pollution. The optimal level of pollution is where the marginal cost of pollution control is equal to the marginal social cost of pollution.

6. **Conclusion**

Economic growth or income growth is a prerequisite for sustainable poverty reduction. Sustainable poverty reduction is a necessary condition for sustainable economic development. In the past, since environment was considered as a free good, the growth path that was pursued often caused serious environmental damage and imposed considerable costs to both the current and the future generations. If society continue to ignore the market imperfections when dealing with the environment, then the welfare gain from income growth may be outweighed by the losses from the environmental damage. This is further exacerbated by the fact that the beneficiaries of higher income are often different from those who suffer the costs of environmental degradation. The beneficiaries of higher income are to a greater extent able to cushion themselves against the environmental damage caused by such a growth path.

The above argument should not be seen as an advocate for less production. Rather it should lead to environmentally friendly economic activity. Effective incentive based market policies and institutions that were suggested earlier will increase the income growth that is necessary for sustainable development, and this increase in income growth will provide for the resources that are necessary for better environmental management.

Thus economic policies and environmental policies should be integrated together when formulating development policies, such that the individual behaviour
will take account of the true social value of the environmental resources. Such policies should rely more on economic incentives. But at the same time remembering that such incentive based policy may not be universally applied to all environmental problems. Market based incentives not only reduce the costs of compliance but also are administratively more simple than regulatory policies such as environmental standards setting. The market based incentive policies also provide the necessary impetus to innovate new pollution control devices and low waste technologies.

In other words, the private and social costs of development should not be allowed to diverge but to converge if society is to achieve a sustainable economic development. The institution for environmental management should not only have engineers to design solutions to environmental problems caused by economic growth, but also should have a mix of social scientists such as economists and sociologists to identify the root cause of the environmental problem and to formulate environmental policies that will be compatible with the goal of overall income growth.

Last but not the least, there is a lot of work to be done by individuals, by society, and by governments, if humans are to win this battle of sustainable economic development for the future generations are that the aspirations of the present generation are met without compromising the ability of future generations to meet their own aspirations.
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